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RESEARCH BRIEF

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MRSA in 2007 Florida Hospitalizations

Introduction

This Research Brief examines the incidence of Methicillin-resistant *Staphylococcus Aureus* (MRSA) found in the 2007 Florida hospital inpatient data. It provides details on MRSA hospitalizations in Florida and what types of patients were affected.

Staphylococcus Aureus are bacteria frequently carried on the skin or nostrils of healthy people, and are the causes of most minor skin infections such as pimples and boils. However, they can also lead to more serious conditions like pneumonia and bloodstream infection. Some of the *Staphylococcus Aureus* bacteria are resistant to commonly used antibiotics such as *methicillin* and *oxacillin*, and those are referred to as *Methicillin*-resistant *Staphylococcus Aureus* (MRSA).

MRSA infections frequently occur among patients in healthcare facilities who undergo a surgical procedure or have a weakened immune system. Healthy people outside of hospitals can also acquire MRSA through cuts, crowded living conditions or poor hygiene. Such infections are referred to as community-associated MRSA.

As of January 2007, Florida hospitals were required to report "present on admission" (POA) indicators for each diagnosis in the inpatient discharge data provided quarterly to the Agency for Health Care Administration. The POA indicator differentiates conditions present when a patient is admitted to the hospital from conditions that occurred during a patient's stay. Although it is not possible to fully determine if the infections were community or hospital acquired, this brief identifies MRSA cases that were reported as present and not present on admission. Excluded from data were infants whose hospital stay began at their own birth.

The records with a MRSA infection also listed the *Staphylococcus Aureus* related conditions identified in the patients. Consistent with the Centers for Disease Control's (CDC) methodology, the discharges with *Staphylococcus Aureus* and MRSA related diagnoses were identified by using the International Classification of Diseases, Ninth Revision (ICD-9-CM) codes specific for *Staphylococcus Aureus* infection: 038.11 (*Staphylococcus Aureus* septicemia), 482.41 (*Staphylococcus Aureus* pneumonia), 041.11 (*Staphylococcus Aureus* infection in conditions classified elsewhere or of unspecified site), and V09.0 (Infections with microorganisms resistant to penicillins). If a record listed multiple *Staphylococcus Aureus* related diagnoses, Septicemia took precedence, followed by *Staphylococcus Aureus* pneumonia. In addition, such records were counted only once for the analysis.

Findings

In 2007, there were 48,043 hospitalizations with a MRSA infection in Florida, two percent of all inpatient hospitalizations. The overall Florida MRSA hospitalization rate was approximately 2.6 per 1,000 population. The average total charges, the average number of hospitalization days, and the percentage of patients who died with a MRSA infection were over two times higher compared to those hospitalized without the infection, as shown in Table 1.

Table 1. Hospitalizations with and without a MRSA infection in Florida and their death percentage, average length of stay and average total charges, 2007

MRSA	Average Length of Stay (days)	Average Total Charges	Death Percentage	Number of Hospitalizations
No	4.80	$33,687.02	1.98%	2,284,580
Yes	11.29	$70,644.17	4.88%	48,043
Total	4.93	$34,448.19	2.04%	2,332,623

Source: AHCA 2007 Inpatient Data.

Tables 2 and 3 illustrate the characteristics of patients hospitalized in Florida and their proportions of hospitalizations with a MRSA infection. A higher percentage of male patients were hospitalized with MRSA compared to females, demonstrating a higher MRSA rate of approximately 2.8 MRSA related admissions per 1,000 male population compared to 2.3 per 1,000 female population. Also, the groups of ages 45 and over had the highest proportion of MRSA hospitalizations and the highest MRSA rates (2.8 per 1,000 population for ages 45-64, and 6.6 per 1,000 population for over 65). These two groups represent the majority of the MRSA hospitalizations (72.3%). Generally, people over 45 have a higher mortality rate than any other age group which may be associated with the higher death percentage among the hospitalizations with a MRSA infection compared to non-MRSA. However, overall, the MRSA rate increased with patient age. These findings are consistent with nationally published data showing a higher MRSA rate among males and elderly[2,4].

Table 2. Hospitalizations with and without a MRSA infection in Florida by Gender, 2007

	Florida Hospitalizations					Florida MRSA rate per 1,000 population
Gender	No MRSA		MRSA		Total Hospitalizations	
Male	965,184	97.36%	26,131	2.64%	991,315	2.85
Female	1,319,396	98.37%	21,912	1.63%	1,341,308	2.29
Total	2,284,580	97.94%	48,043	2.06%	2,332,623	2.60

Source: AHCA 2007 Inpatient Data. Population statistics: The Florida Legislature, Office of Economic and Demographic Research.

Table 3. Hospitalizations with and without a MRSA infection in Florida Age Group, 2007

	Florida hospitalizations					Florida MRSA rate per 1,000 population
Age	No MRSA		MRSA		Total Hospitalizations	
Ages <18	144,975	97.84%	3,202	2.16%	148,177	0.77
Ages 18-24	149,244	98.86%	1,724	1.14%	150,968	1.02
Ages 25-44	462,939	98.22%	8,371	1.78%	471,310	1.73
Ages 45-64	591,663	97.76%	13,563	2.24%	605,226	2.82
Ages 65+	935,759	97.79%	21,183	2.21%	956,942	6.60
Total	2,284,580	97.94%	48,043	2.06%	2,332,623	2.60

Source: AHCA 2007 Inpatient Data. Population statistics: The Florida Legislature, Office of Economic and Demographic Research.

Despite the insufficient amount of clinical evidence to differentiate the infections acquired in the hospital from those community-associated, the results shown in Table 4 suggest that the majority of the patients with a MRSA infection were admitted to the hospital already infected. Over eighty-three percent of the MRSA hospitalizations were reported to be present on admission. Particularly, patients of the age 44 and below had higher proportions of MRSA hospitalizations present on admission compared to those over 45. MRSA literature states that children, military recruits and athletes are at a higher risk for community-associated MRSA infections[1], which may explain the higher proportion of MRSA hospitalizations present on admission among younger patients.

Table 4. Hospitalizations with MRSA by Age and Present on Admission (POA) Indicators, 2007

	Present on Admission Indicators					
Age	Yes	No	Unknown	Clinically Undetermined	Missing	Total
Ages <18	2,745	195	177	2	83	3,202
Ages 18-24	1,476	141	74	1	32	1,724
Ages 25-44	7,274	577	379	5	136	8,371
Ages 45-64	11,386	1,389	537	12	239	13,563
Ages 65+	17,132	2,613	899	43	496	21,183
Total	40,013	4,915	2,066	63	986	48,043
Ages <18	85.73%	6.09%	5.53%	0.06%	2.59%	100.00%
Ages 18-24	85.61%	8.18%	4.29%	0.06%	1.86%	100.00%
Ages 25-44	86.90%	6.89%	4.53%	0.06%	1.62%	100.00%
Ages 45-64	83.95%	10.24%	3.96%	0.09%	1.76%	100.00%
Ages 65+	80.88%	12.34%	4.24%	0.20%	2.34%	100.00%
Total	83.29%	10.23%	4.30%	0.13%	2.05%	100.00%

Source: AHCA 2007 Inpatient Data.

The majority of MRSA hospitalizations are admitted through the emergency department (72.17%). Some hospitals will admit nursing home transfer patients through the Emergency Room, thus inflating the

number of Emergency Room admissions and underestimating the number of patients transferred from skilled nursing and other facilities. Table 5 shows that the hospitalizations transferred from skilled nursing facilities, hospitals and other health care facilities had the highest proportions of patients with a MRSA infection.

The majority of the patients were admitted to the hospitals with a MRSA infection present on admission, as shown in Table 6, and those transferred from skilled nursing facilities had the highest proportion of MRSA infection present before hospitalization, followed by transfers from other health facilities. MRSA is prevalent in long term health care facilities, and in areas of close contact with health care workers[1].

Table 5. Hospitalizations with and without a MRSA infection in Florida by Admission Source, 2007

Admission Source	No MRSA		MRSA		Total Hospitalizations
Transfer from a Skilled Nursing Facility	1,849	93.15%	136	6.85%	1,985
Transfer from a Hospital	54,967	96.01%	2,286	3.99%	57,253
Transfer from Other Facility	7,013	96.93%	222	3.07%	7,235
Emergency Room	1,374,877	97.54%	34,674	2.46%	1,409,551
Other	845,874	98.75%	10,725	1.25%	856,599
Total	2,284,580	97.94%	48,043	2.06%	2,332,623

Source: AHCA 2007 Inpatient Data.

Table 6. Hospitalizations with MRSA by Admission Source and Present on Admission (POA) Indicators, 2007

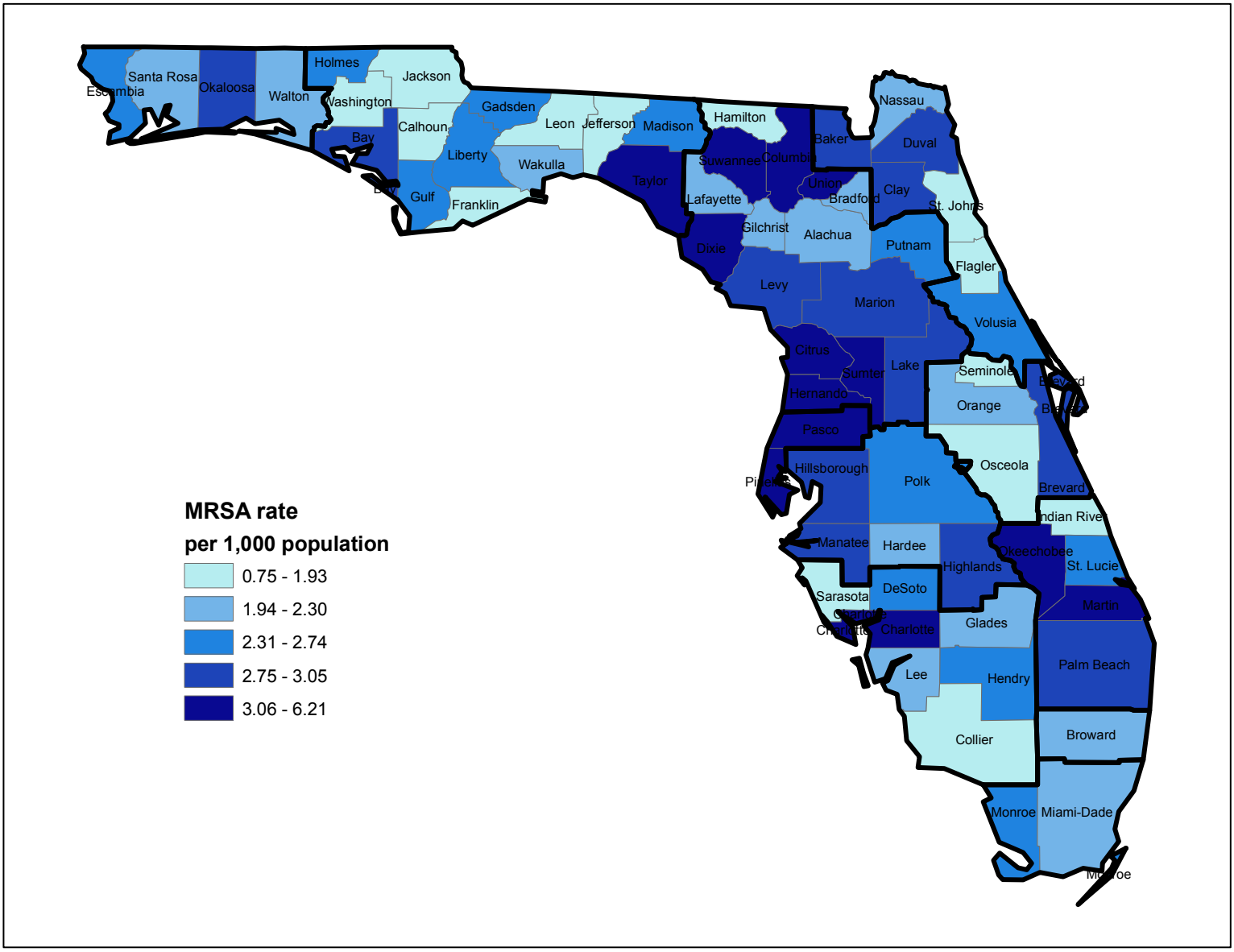
Admission Source	Yes	No	Unknown	Clinically Undetermined	Missing	Total
Transfer from a Skilled Nursing Facility	121	8	5	0	2	136
Transfer from a Hospital	1,667	331	91	3	194	2,286
Transfer from Other Facility	184	29	5	1	3	222
Emergency Room	29,008	3,571	1,454	46	595	34,674
Other	9,033	976	511	13	192	10,725
Total	40,013	4,915	2,066	63	986	48,043
Transfer from a Skilled Nursing Facility	88.97%	5.88%	3.68%	0.00%	1.47%	100.00%
Transfer from a Hospital	72.92%	14.48%	3.98%	0.13%	8.49%	100.00%
Transfer from Other Facility	82.88%	13.06%	2.25%	0.45%	1.35%	100.00%
Emergency Room	83.66%	10.30%	4.19%	0.13%	1.72%	100.00%
Other	84.22%	9.10%	4.76%	0.12%	1.79%	100.00%
Total	83.29%	10.23%	4.30%	0.13%	2.05%	100.00%

Source: AHCA 2007 Inpatient Data.

Figure 1 provides the geographic differences in MRSA hospitalization rates across the counties. The darker shaded counties represent the counties with higher MRSA rates compared to lighter counties. The rates by county were calculated by identifying each patient's county of residency. National studies

indicate associations between the MRSA rate and region, however, the reasons for this variability remains unclear[3].

Figure 1. MRSA Hospitalizations Rate by County, 2007



Eleven percent of the hospitalizations with a MRSA infection were associated with Septicemia, and ten percent with pneumonia. The remainder of the records was associated with *Staphylococcus Aureus* infections in conditions classified elsewhere or of an unspecified site. The *Staphylococcus Aureus* related conditions and the MRSA infections can only appear as a secondary diagnosis. The principal diagnosis is the main reason for a hospital admission, and may be unrelated to the MRSA infection. Table 7 lists the top principal diagnoses among the MRSA hospitalizations by Major Diagnostic Categories (MDC) and age

groups. Conditions related to circulatory system disorders were the main principal diagnoses for hospitalizations with a MRSA infection across all age groups. However, MRSA patients younger than 18 years of age had the highest proportion of admitting conditions related to the circulatory system.

Table 7. Hospitalizations with MRSA by Major Diagnostic Categories (MDC) and Age Groups, 2007

	Age Group					
MDC	Ages <18	Ages 18-24	Ages 25-44	Ages 45-64	Ages 65+	Total
Circulatory System	1,507	677	3,418	3,911	4,107	13,620
Skin, Subcutaneous Tissue and Breast	584	262	1,354	2,026	2,847	7,073
Musculoskeletal System and Connective Tissue	153	167	851	1,860	2,818	5,849
Other	192	144	787	1,451	2,817	5,391
Nervous System	253	112	379	959	2,932	4,635
Respiratory System	128	50	262	755	1,726	2,921
Ear, Nose, Mouth and Throat	63	40	324	708	869	2,004
Infectious and Parasitic Diseases	42	32	190	505	938	1,707
Digestive System	164	176	405	339	603	1,687
Hepatobiliary System and Pancreas	101	51	289	642	557	1,640
Eye	12	7	70	295	601	985
Kidney and Urinary Tract	3	6	42	112	368	531
Total	3,202	1,724	8,371	13,563	21,183	48,043
Circulatory System	47.06%	39.27%	40.83%	28.84%	19.39%	28.35%
Skin, Subcutaneous Tissue and Breast	18.24%	15.20%	16.17%	14.94%	13.44%	14.72%
Musculoskeletal System and Connective Tissue	4.78%	9.69%	10.17%	13.71%	13.30%	12.17%
Other	6.00%	8.35%	9.40%	10.70%	13.30%	11.22%
Nervous System	7.90%	6.50%	4.53%	7.07%	13.84%	9.65%
Respiratory System	4.00%	2.90%	3.13%	5.57%	8.15%	6.08%
Ear, Nose, Mouth and Throat	1.97%	2.32%	3.87%	5.22%	4.10%	4.17%
Infectious and Parasitic Diseases	1.31%	1.86%	2.27%	3.72%	4.43%	3.55%
Digestive System	5.12%	10.21%	4.84%	2.50%	2.85%	3.51%
Hepatobiliary System and Pancreas	3.15%	2.96%	3.45%	4.73%	2.63%	3.41%
Eye	0.37%	0.41%	0.84%	2.18%	2.84%	2.05%
Kidney and Urinary Tract	0.09%	0.35%	0.50%	0.83%	1.74%	1.11%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Source: AHCA 2007 Inpatient Data.

Table 8 shows the principal conditions in which the patients were admitted to the hospitals with a MRSA infection present or not present on admission. Infectious and Parasitic Diseases was the MDC with the highest proportion of hospitalizations with MRSA present on admission (94.49%), and Musculoskeletal System and Connective Tissue was the highest among hospitalizations with a MRSA infection not present on admission (22.06%).

Table 8. Hospitalizations with MRSA by Major Diagnostic Categories (MDC) and Present on Admission (POA) Indicator, 2007

	Present on Admission Indicator					
MDC	Yes	No	Unknown	Clinically Undetermined	Missing	Total
Infectious and Parasitic Diseases	1,613	60	32	2	0	1,707
Skin, Subcutaneous Tissue and Breast	6,437	271	249	2	114	7,073
Kidney and Urinary Tract	468	56	7	0	0	531
Circulatory System	11,881	725	676	19	319	13,620
Ear, Nose, Mouth and Throat	1,721	157	79	2	45	2,004
Hepatobiliary System and Pancreas	1,400	113	87	1	39	1,640
Respiratory System	2,400	375	107	7	32	2,921
Eye	795	132	42	2	14	985
Nervous System	3,738	460	247	9	181	4,635
Digestive System	1,332	261	72	3	19	1,687
Other	4,108	1,015	196	7	65	5,391
Musculoskeletal System and Connective Tissue	4,120	1,290	272	9	158	5,849
Total	40,013	4,915	2,066	63	986	48,043
Infectious and Parasitic Diseases	94.49%	3.51%	1.87%	0.12%	0.00%	100.00%
Skin, Subcutaneous Tissue and Breast	91.01%	3.83%	3.52%	0.03%	1.61%	100.00%
Kidney and Urinary Tract	88.14%	10.55%	1.32%	0.00%	0.00%	100.00%
Circulatory System	87.23%	5.32%	4.96%	0.14%	2.34%	100.00%
Ear, Nose, Mouth and Throat	85.88%	7.83%	3.94%	0.10%	2.25%	100.00%
Hepatobiliary System and Pancreas	85.37%	6.89%	5.30%	0.06%	2.38%	100.00%
Respiratory System	82.16%	12.84%	3.66%	0.24%	1.10%	100.00%
Eye	80.71%	13.40%	4.26%	0.20%	1.42%	100.00%
Nervous System	80.65%	9.92%	5.33%	0.19%	3.91%	100.00%
Digestive System	78.96%	15.47%	4.27%	0.18%	1.13%	100.00%
Other	76.20%	18.83%	3.64%	0.13%	1.21%	100.00%
Musculoskeletal System and Connective Tissue	70.44%	22.06%	4.65%	0.15%	2.70%	100.00%
Total	83.29%	10.23%	4.30%	0.13%	2.05%	100.00%

Source: AHCA 2007 Inpatient Data.

The primary source of reimbursement for over half of the MRSA hospitalizations in Florida was Medicare, an amount of approximately 1.9 billion dollars in total charges. On average, the total reimbursement for a hospitalization with a MRSA infection was nearly double compared to a non-MRSA hospitalization for most payer groups. For Medicaid, the total charges of a MRSA hospitalization were three times higher than of a non-MRSA. The distribution of payer types in hospitalizations with a MRSA infection is shown in Figure 2, and Table 8 presents the average total charges for each payer type.

Figure 2. Payer Types and Total Charges for MRSA Hospitalizations

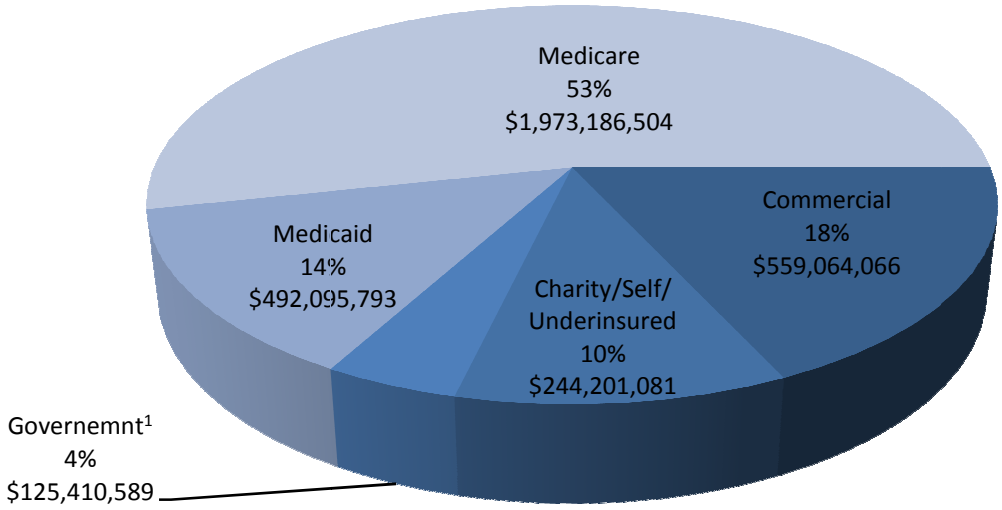


Table 8. Hospitalizations with and without a MRSA infection and their average total charges by payer type, 2007

	Non MRSA		MRSA	
Payer Group	Average Total Charges	Number of Hospitalizations	Average Total Charges	Number of Hospitalizations
Commercial	$31,419.13	641,523	$64,260.24	8,700
Charity/Self/Underinsured	$27,126.05	192,273	$48,052.16	5,082
Government[1]	$32,957.91	85,954	$60,409.72	2,076
Medicaid	$25,547.82	333,679	$75,094.73	6,553
Medicare	$39,015.96	1,031,151	$76,981.37	25,632
Total	$33,687.02	2,284,580	$70,644.17	48,043

Source: AHCA 2007 Inpatient Data.

[1] Workers' Compensation, CHAMPUS, Veteran's Affairs, Kidcare and Other State or Local Government.

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